Gas Law Practice Problems for Chapter 14 Test Name Key

1. A gas occupies a volume of 140 mL at 35oC and 97kPa. What is the volume of the gas at STP?

$P_1 = 97\,kpa$ $P_2 = 101.3\,kpa$ $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $V_2 = \frac{P_1V_1T_2}{T_1P_2}$

$V_1 = 140\,mL$ $V_2 = X$

$T_1 = 308\,K$ $T_2 = 273\,K$

$$\frac{(97\,kpa)(140mL)(273K)}{(308K)(101.3\,kpa)} = \boxed{120mL}$$

2. 20.0 g each of helium and an unknown diatomic gas are combined in a 1500. mL container. If the temperature is 298 K, and the pressure inside is 86.11 atm; what is the unknown gas

HINT: CONSIDER DALTONS LAW OF PARTIAL PRESSURE

$PV=nRT$ $n=\frac{m}{MM}$ $P_{He} = \frac{mRT}{MV} = 20.0g\left(\frac{1mol}{4.00g}\right)\left(\frac{0.0821L\cdot atm}{K\cdot mol}\right)\left(\frac{298K}{1}\right)\left(\frac{1}{1.5L}\right) = 81.55\,atm.$

Total pressure $- P_{HE} = P_{unknown}$

$86.11atm - 81.55 = 4.56atm$

$PV = \frac{m}{M}RT$ $M = \frac{mRT}{PV}$ $20g\left(\frac{0.0821L\cdot atm}{K\cdot mol}\right)\left(\frac{298K}{1}\right)\left(\frac{1}{1.5L}\right)\left(\frac{1}{4.56\,atm}\right)$

$71g/mol = \boxed{Cl_2}$

3. Consider the hydrocarbon pentane, C_5H_{12} (molar mass 72.15g)

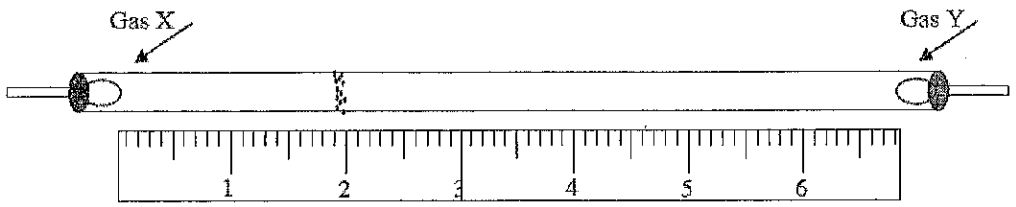
(a.) Write the balanced equation for the combustion of pentane to yield carbon dioxide and water.

$$\underset{A}{C_5H_{12}} + 8O_2 \longrightarrow \underset{B}{5CO_2} + 6H_2O$$

(b.) What volume of dry carbon dioxide, measured at 25oC and 785 mmHg, will result from the complete combustion of 2.50 g of pentane? $PV=nRT$ $V=\frac{nRT}{P}$

$$\underbrace{2.50g\left(\frac{1mol_A}{72g}\right)\left(\frac{5mol_B}{1mol_A}\right)}_{n\text{ of }CO_2}\left(\frac{62.4\,mmHg\cdot L}{K\cdot mol}\right)\left(\frac{298K}{1}\right)\left(\frac{1}{785mmHg}\right) = \boxed{4.1L}$$

The following are the results of a diffusion experiment using two chemicals that forma precipitate when they react. The chemical Y is Oxygen.



4. What is the molar mass of chemical X?

$\frac{rate_{O_2}}{rate_{unknown}} = \frac{5}{2} = \frac{T_X}{T32}$

$5\sqrt{32} = 2\sqrt{X}$

$\frac{5\sqrt{32}}{2} = \sqrt{X}$

$14.14^2 = X$

$\boxed{X = 200\,g/mol}$